HEATHKIT® MANUAL

HEATH COMPANY • BENTON HARBOR, MICHIGAN

YOUR HEATHKIT 90-DAY FULL WARRANTY

If you are not satisfied with our service - warranty or otherwise - or with our products, write directly to our Director of Customer Services, Heath Company, Benton Harbor, Michigan 49022. He will make certain your problems receive immediate, personal attention.

Our attorney, who happens to be quite a kitbuilder himself, insists that we describe our warranty using all the necessary legal phrases in order to comply with the new warranty regulations. Fine. Here they are:

For a period of ninety (90) days after purchase, Heath Company will replace or repair free of charge any parts that are defective either in materials or workmanship. You can obtain parts directly from Heath Company by writing us at the address below or by telephoning us at (616) 982-3571. And we'll pay shipping charges to get those parts to you — anywhere in the world.

We warrant that during the first ninety (90) days after purchase, our products, when correctly assembled, calibrated, adjusted and used in accordance with our printed instructions, will meet published specifications.

If a defective part or error in design has caused your Heathkit product to malfunction during the warranty period through no fault of yours, we will service it free upon proof of purchase and delivery at your expense to the Heath factory, any Heathkit Electronic Center (units of Schlumberger Products Corporation), or any of our authorized overseas distributors.

You will receive free consultation on any problem you might encounter in the assembly or use of your Heathkit product. Just drop us a line or give us a call. Sorry, we cannot accept collect calls.

Our warranty does not cover and we are not responsible for damage caused by the use of corrosive solder, defective tools, incorrect assembly, misuse, fire, or by unauthorized modifications to or uses of our products for purposes other than as advertised. Our warranty does not include reimbursement for customer assembly or set-up time.

This warranty covers only Heathkit products and is not extended to allied equipment or components used in conjunction with our products. **We are not responsible for incidental or consequential damages.** Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you. This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

HEATH COMPANY
BENTON HARBOR, MI. 49022

HEATH COMPANY PHONE DIRECTORY

The following telephone numbers are direct lines to the departments listed:

Kit orders and delivery information	(616) 982-3411
Credit	(616) 982-3561
Replacement Parts	(616) 982-3571
Technical Assistance:	
R/C, Audio, and Electronic Organs	(616) 982-3310
Amateur Radio	(616) 982-3296
Test Equipment, Strobe Lights, Calculators, Clocks, Weather Instruments	(616) 982-3315
Television	(616) 982-3307
Automotive, Marine, Appliances, Security, General Products	(616) 982-3496

Prices and specifications subject to change without notice.

Heathkit® Manual

for the

2-METER AMPLIFIER

Model HA-201

595-1653-04

HEATH COMPANY
BENTON HARBOR, MICHIGAN 49022

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INTRODUCTION

The Heathkit Model HA-201 2-Meter Amplifier is a compact amplifier designed for mobile or fixed station use in conjunction with a transceiver or transmitter capable of producing from 1 to 3 watts of FM driving power. The output power of the Amplifier will be up to 10 watts, depending upon the driving power.

A kit-built RF probe used with a VTVM or a volt-ohmmeter, and a dummy load enables you to align the amplifier without special equipment.

This amplifier features automatic antenna switching and all-solid-state design to assure you of stable, trouble-free operation. All necessary cable, hardware, and connectors are provided for the installation and operation of your amplifier.

This Amplifier is designed to operate from any 12 to 16-volt DC power supply, such as an automobile power system or the Heathkit HWA-202-1 Power Supply.

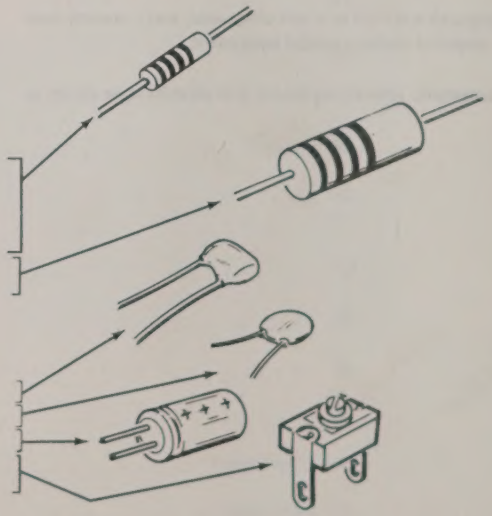
Read the "Kit Builders Guide" for complete information on unpacking, parts identification, tools, wiring, soldering, and step-by-step assembly procedures.

PARTS LIST

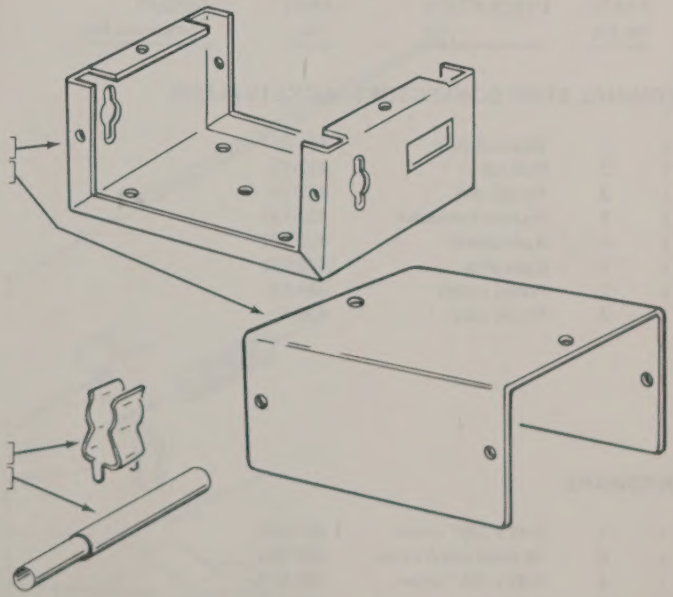
Check each part against the following list. Make a check (✓) in the space provided as each part is identified. Any part that is packed in an individual envelope with the part number on it should be placed back in the envelope after it is identified until it is called for in a step. Do not throw away any packing materials until all parts are accounted for.

To order a replacement part, use the Parts Order Form furnished with this kit. If a Parts Order Form is not available, refer to "Replacement Parts" inside the rear cover of the Manual. For pricing information, refer to the separate "Heath Parts Price List."

	PARTS Per Kit	DESCRIPTION	PART No.	CIRCUIT Component No.
RESISTORS				
( )	1	22 Ω, 1/2-watt (red-red-black)	1-49	R1
( )	1	10 kΩ, 1/2-watt (brown-black-orange)	1-20	R2
( )	2	100 Ω, 2-watt (brown-black-brown)	1-20-2	R3, R4
CAPACITORS				
( )	2	62 pF mica	20-109	C6, C7
( )	2	.001 μF disc	21-140	C8, C11
( )	1	100 μF electrolytic	25-117	C9
( )	5	8-60 pF trimmer	31-52	C1, C2, C3, C4, C5



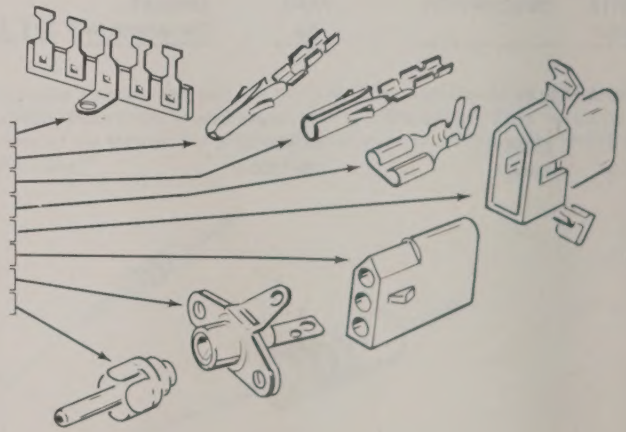
PARTS Per Kit	DESCRIPTION	PART No.	CIRCUIT Component No.
TAL PARTS			
1	Chassis	200-688-2	
1	Cover	206-1106-2	
2	Fuse clip	260-65	
1	Extractor	490-112	



PARTS Per Kit		DESCRIPTION	PART No.	CIRCUIT Component No.

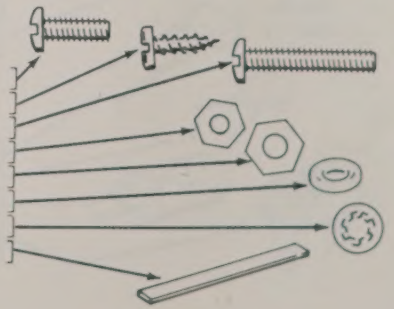
TERMINAL STRIP-CONNECTORS-SOCKETS-PLUGS

( )	1	Terminal strip	431-39
( )	2	Male pin	432-72
( )	2	Female pin	432-73
( )	1	Push-on connector	432-137
( )	1	3-pin socket	432-720
( )	1	3-pin plug	432-723
( )	2	Phono socket	434-42
( )	3	Phono plug	438-4

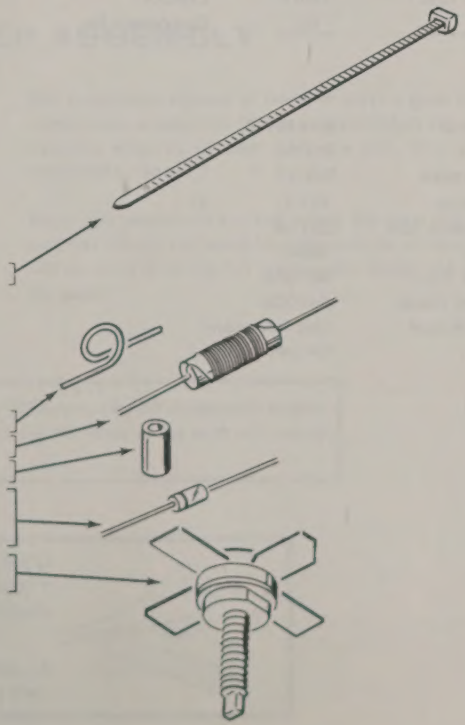


HARDWARE

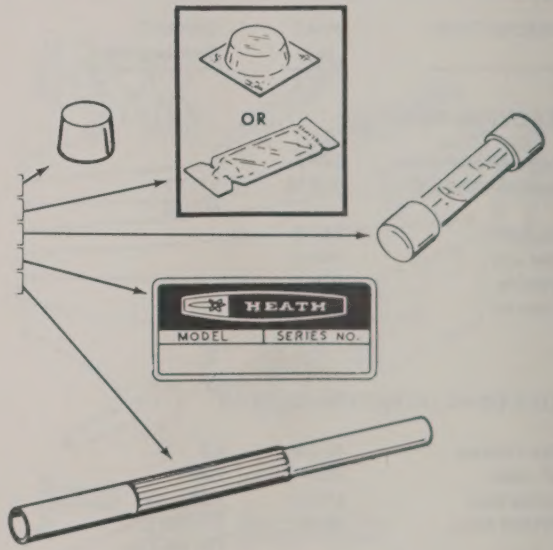
( )	4	6-32 x 3/8" screw	250-381
( )	6	#6 sheet metal screw	250-155
( )	4	6-32 x 3/4" screw	250-569
( )	12	6-32 nut	252-3
( )	1	8-32 nut	252-4
( )	1	O-ring	253-28
( )	16	#6 lockwasher	254-1
( )	1	1" blade	205-778



PARTS Per Kit	DESCRIPTION	PART No.	CIRCUIT Component No.
E-CABLE-SLEEVING-TIES			
1	Large shielded cable	343-2	
1	Small shielded cable	343-15	T1, T2 (other)
1	Black wire	344-2	
1	Red wire	344-3	
1	Sleeving	346-1	
4	Cable tie	354-5	
UCTOR-CHOKE-BEAD-DIODE-TRANSISTOR			
1	Wire inductor	40-936	L2
1	RF choke	45-37	RFC1
1	Ferrite bead	475-10	FB1
7	1N4149 diode	56-56	D1, D2, D3, D4, D5, D6, D7
1	2N6081 or CTC B12-12 transistor	417-803	Q1



	PARTS Per Kit	DESCRIPTION	PART No.	CIRCUIT Component No.
MISCELLANEOUS				
( )	1	Circuit board	85-1467-2	
( )	4	Foot	261-42	
( )	1	Silicone grease	352-13	
( )	1	3-ampere fuse	421-2	F1
( )	1	Blue and white label	391-34	
( )	1	Nut starter	490-5	
( )	1	Parts Order Form	597-260	
( )	1	Kit Builders Guide	597-308	
( )	1	Assembly Manual	(See front cover for part number.)	
		Solder		



STEP-BY-STEP ASSEMBLY

Before you start to assemble this kit, read the "Kit Builders Guide" for complete information on wiring, soldering, and step-by-step assembly procedures.

CIRCUIT BOARD ASSEMBLY

Resistors are designated by the color code (see the "Kit Builders Guide") and the resistance value. Capacitors are designated by their value and type.

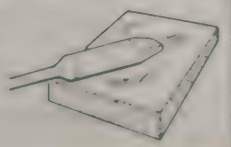
Use a minimum amount of solder to make a good connection and do not heat components excessively. Diodes and transistors can be damaged if subjected to excessive amounts of heat. Solder a part, or a group of parts, only when instructed to do so.

When you assemble the circuit board, the parts will usually be installed on the screened side of the board (the side with the component outlines), and the leads will be soldered to the foil (other) side. Solder the leads only to the foil side of the board.

SAFETY WARNING: Avoid eye injury when you clip off excess lead lengths. We suggest you wear glasses, or at least clip the leads so the ends will not fly toward your eyes.

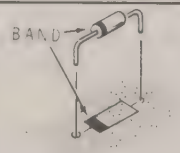
FOR GOOD SOLDERED CONNECTIONS, YOU MUST KEEP THE SOLDERING IRON TIP CLEAN...

WIPE IT OFTEN WITH A DAMP SPONGE OR CLOTH.



START

Position the circuit board as shown; then proceed with the following steps.



Be sure to always match the banded end of the diode with the banded outline on the circuit board as shown.

( ) D6: 1N4149 (#56-56).

( ) D5: 1N4149 (#56-56).

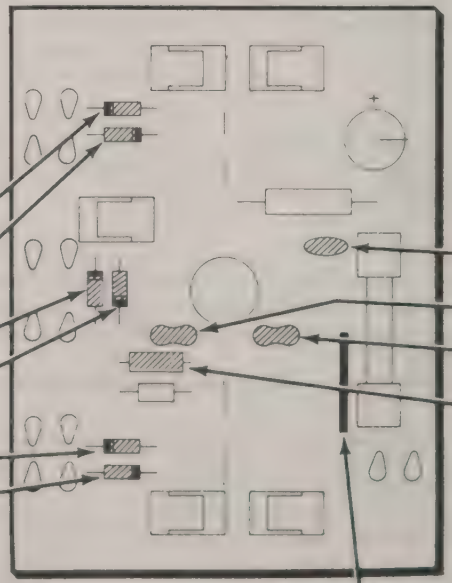
( ) D4: 1N4149 (#56-56).

( ) D3: 1N4149 (#56-56).

( ) D2: 1N4149 (#56-56).

( ) D1: 1N4149 (#56-56).

( ) Solder the leads to the foil and cut off the excess lead lengths.



PICTORIAL 1

CONTINUE

NOTE: Check the leads of each disc or mica capacitor as you install it. Remove the coating from each capacitor as shown. This coating could cause a bad solder connection.

( ) C8: .001 µF disc.

( ) C7: 62 pF mica.

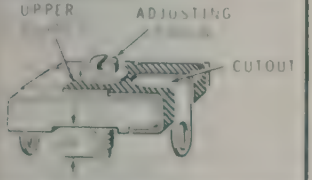
( ) C6: 62 pF mica.

( ) R1: 22 Ω (red-red-black). Save the cutoff resistor leads for use later.

( ) Solder the leads to the foil and cut off the excess lead lengths.

START

NOTE: Carefully study the top of the 8-60 pF trimmers (#31-52) which you will install in the following steps. Note the upper plate on the top of the trimmer, directly under the screw and washer. This plate must be positioned exactly as shown in the Pictorial. Turn the screw down snugly before you mount a trimmer to allow proper screw clearance. Then solder the leaves of each trimmer as it is installed on the circuit board.



( ) C3: 8-60 pF trimmer.

( ) C4: 8-60 pF trimmer.

( ) C5: 8-60 pF trimmer.

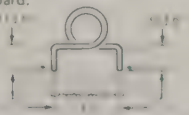
( ) C6: 8-60 pF trimmer.

( ) C7: 8-60 pF trimmer.

PICTORIAL 2

CONTINUE

( ) L2: Bend the leads of the wire inductor (#40-936) as shown. Then mount the inductor on the circuit board.



( ) RFC1: RF choke (#45-37). Bend the leads toward the slot in the coil form.

( ) Solder the leads to the foil and cut off the excess lead length.

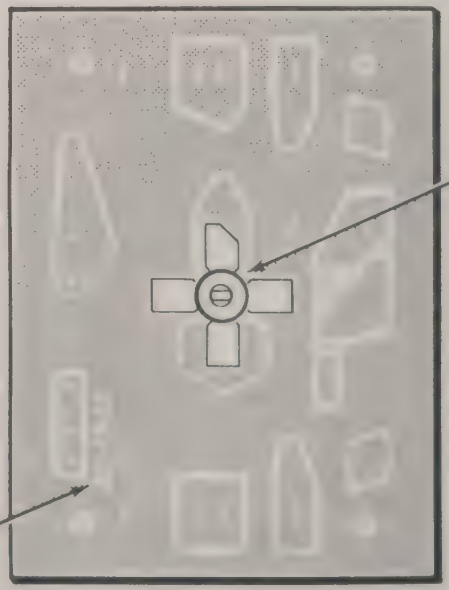
( ) Install the 3-ampere fuse in the two fuse clips. Then mount the fuse clips in the circuit board as shown. Position each clip so its shoulders are away from the other clip. Then solder the clips to the foil.

START

IMPORTANT If the power transistor (#417-803) is type 2N6081, install it as shown in this Pictorial. If the transistor is type CTC B12-12, follow the steps on Page 13 and disregard this page.

( ) Turn the circuit board foil-side-up so the board part number is in the position shown.

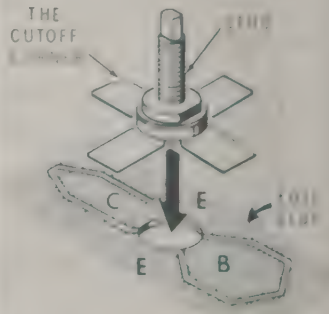
CAUTION: Handle the power transistor, particularly the stud, with care.



PICTORIAL 3

CONTINUE

( ) Q1: From the foil side of the circuit board, place the round, white, top portion of a 2N6081 transistor into the hole shown. Position the lead with the cutoff corner as shown. Flatten the leads down against the foil for as much of their length as possible. Solder each lead to the foil. Carry the solder up as close as possible to the transistor body to reduce the effective length of the leads.



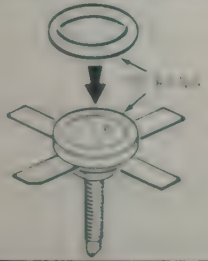
START

IMPORTANT: Follow this Pictorial ONLY if you were furnished a CTC type B12-12 power transistor (#417-803).

CAUTION: Handle the power transistor, particularly the stud, with care.

( ) Stretch a white O-ring by rolling it onto a round object such as a pencil. Repeat this action two or three times to stretch the O-ring the maximum amount. Then remove the ring.

( ) Carefully stretch the O-ring onto the round, white top of the transistor.

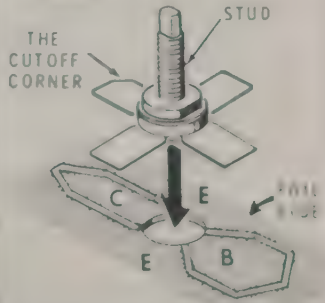


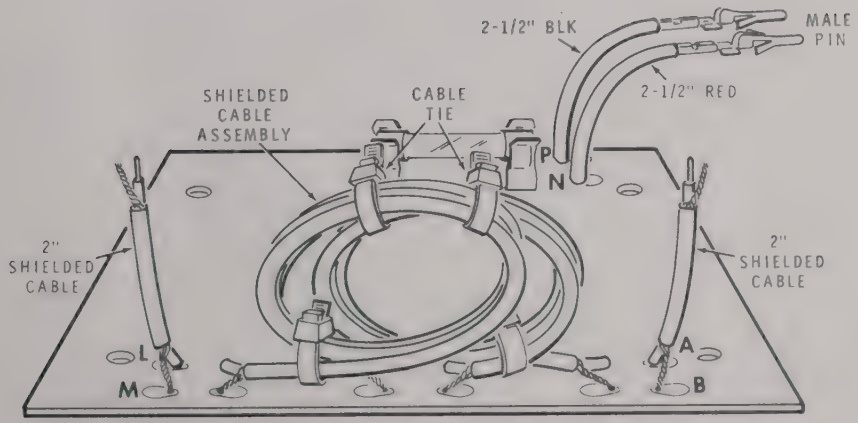
PICTORIAL 4

CONTINUE

( ) Turn the circuit board foil-side-up so the board part number is in the position shown on the Pictorial.

( ) Q1: From the foil side of the circuit board, place the round, white, top portion of a CTC B12-12 transistor into the hole shown. Position the lead with the cutoff corner as shown. Form the leads down against the foil for as much of their length as possible. Solder each lead to the foil. Carry the solder up as close as possible to the transistor body to reduce the effective length of the leads.



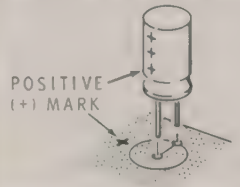

2-1/2" BLK
MALE PIN
2-1/2" RED
SHIELDED CABLE ASSEMBLY
CABLE TIE
P
N
2" SHIELDED CABLE
2" SHIELDED CABLE
L
M
A
B

PICTORIAL 6

START

Turn the circuit board component-side-up and position it as shown.

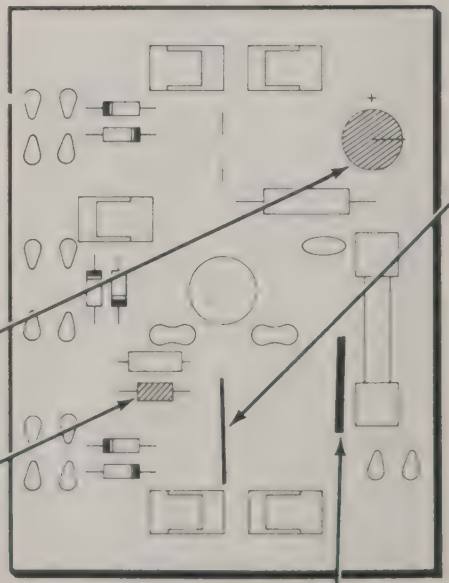
NOTE: When you install vertical electrolytic capacitors, be sure you match the positive (+) marking on the capacitor with the positive (+) marking on the circuit board. Also note that the positive (+) lead hole is in the center of the circular outline.



( ) C9. 100 μF electrolytic.

( ) FB1. Place a ferrite bead on a capacitor lead. Then bend the lead to fit the holes in the circuit board.

( ) Solder the leads to the foil and cut off the excess lead lengths.



PICTORIAL 5

CONTINUE

( ) L1. Use a straight capacitor lead. Bend the lead ends to fit the circuit board holes. Solder the leads to the foil.

CIRCUIT BOARD CHECKOUT

Carefully inspect the circuit board for the following conditions.

( ) Unsoldered connections.

( ) "Cold" solder connections.

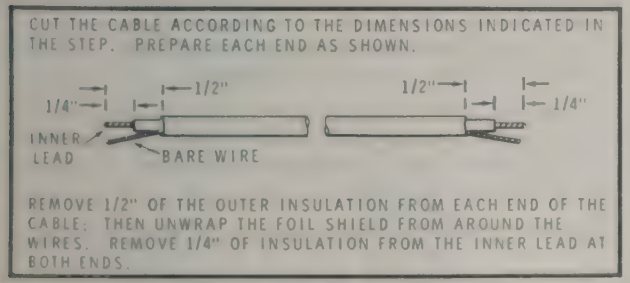
( ) Solder bridges between foil patterns.

( ) Protruding leads which could touch together.

( ) Transistors for the proper type and installation.

( ) Electrolytic capacitors for the correct position of the positive (+) end.

( ) Diodes for the correct position of the banded end.


CUT THE CABLE ACCORDING TO THE DIMENSIONS INDICATED IN THE STEP. PREPARE EACH END AS SHOWN.
1/4"
1/2"
1/2"
1/4"
INNER LEAD
BARE WIRE
REMOVE 1/2" OF THE OUTER INSULATION FROM EACH END OF THE CABLE. THEN UNWRAP THE FOIL SHIELD FROM AROUND THE WIRES. REMOVE 1/4" OF INSULATION FROM THE INNER LEAD AT BOTH ENDS.

Detail 6A

Wire and Cable Installation

Refer to Pictorial 6 (fold-out from Page 14) for the following steps.

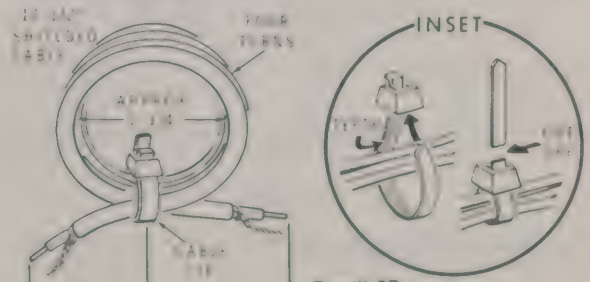
( ) Refer to Detail 6A and prepare the following lengths of small shielded cable:

2"	17-1/2"
2"	17-1/2"

NOTE: As you connect each end of a shielded cable to the circuit board in the following steps, solder both the inner lead and the shield lead to the circuit board foil. Cut off any excess lead lengths.

( ) At one end of a 2" shielded cable, connect the inner lead to hole A (S-1) and the shield lead to hole B (S-1) of the circuit board. The free end will be connected later.

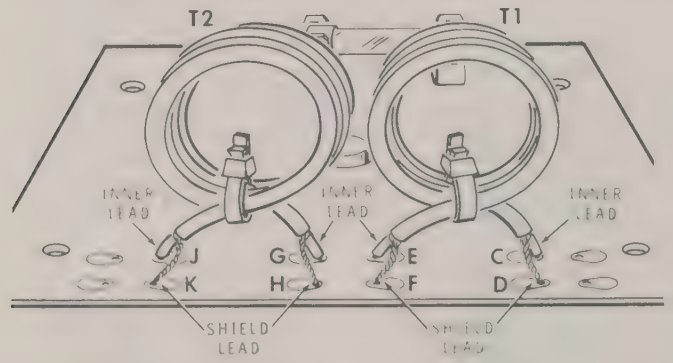
( ) At one end of the other 2" shielded cable, connect the inner lead to hole L (S-1) and the shield lead to hole M (S-1) of the circuit board. The free end will be connected later.



Detail 6B

( ) Refer to Detail 6B and form a 17-1/2" shielded cable into four symmetrical and equal loops as shown. Secure the four loops tightly together near the cable ends with a cable tie as shown in the inset drawing. NOTE: It would be helpful if you temporarily bind the loops together with a piece of thread or plastic tape while you pull the cable tie tight.

( ) In the same manner, form the remaining 17-1/2" shielded cable into four equal loops and secure them with a cable tie.



Detail 6C

Refer to Detail 6C for the following steps.

( ) T1 At one end of one 17-1/2" looped cable, connect the inner lead to hole C (S-1) and the shield lead to hole D (S-1) of the circuit board. At the other end of this cable, connect the inner lead to hole E (S-1) and the shield lead to hole F (S-1) in the circuit board.

( ) T2 Similarly, connect the inner lead of the remaining 17-1/2" looped cable to hole J (S-1) and the shield lead to hole K (S-1). At the other end of the cable, connect the inner lead to hole G (S-1) and the shield lead to hole H (S-1) in the circuit board.

( ) Position the loops of the two shielded cable assemblies together, then press them down toward the top of the circuit board slightly. Secure the two loops, offset in the manner shown in the Pictorial, with two cable ties spaced approximately 1" apart. Pull the ties snug.

NOTE: When you prepare stranded wire, as in the following step, cut the wire to the indicated length, remove 1/4" of insulation from each end, and tightly twist the bare ends together. Apply a small amount of solder to each wire end to hold the small strands together.

( ) Prepare a 2-1/2" black stranded wire and a 2-1/2" red stranded wire.

Detail 6D

( ) Refer to Detail 6D and solder a male pin (#432-72) onto one end of the 2-1/2" black wire as shown.

( ) In the same manner, solder a male pin onto one end of the 2-1/2" red wire.

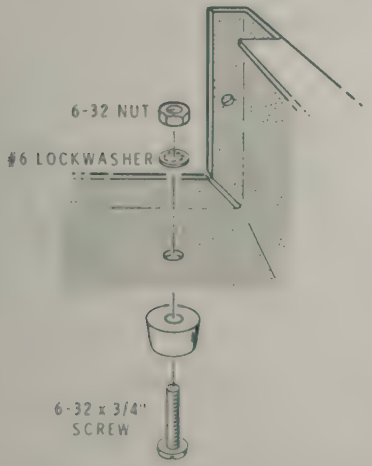
( ) Push the free end of the 2-1/2" black wire into hole P in the circuit board. Solder the wire to the foil and cut off any excess wire length.

( ) In the same manner, solder the free end of the 2-1/2" red wire to hole N in the circuit board (S-1).

( ) Set the circuit board aside temporarily.

CHASSIS ASSEMBLY

efer to Pictorial 7 (fold-out from Page 19) for the following steps.



Detail 7A

NOTE: When hardware is called for in a step, only the screw size will be given. For instance, if 6-32 x 3/8" hardware is called for, it means that a 6-32 x 3/8" screw, one or more #6 lockwashers, and a 6-32 nut should be used. The Pictorial or a Detail will show the proper number of lockwashers used. Use the plastic nut starter to pick up and start 6-32 and 4-40 nuts on screws.

( ) Refer to Detail 7A and loosely mount a foot at A on the underside of the chassis as shown. Use 6-32 x 3/4" hardware.

( ) In the same manner, loosely mount three feet at locations B, C, and D with the 6-32 x 3/4" hardware.

Refer to Detail 7B (fold-out from Page 19) for the following steps.

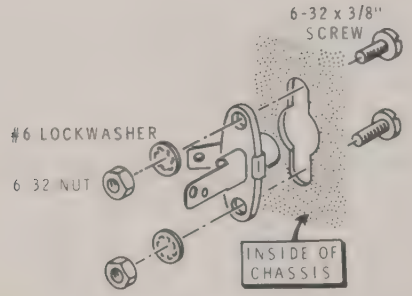
( ) Scrape the paint away from hole X in the chassis.

( ) Refer to the inset drawing on the Detail and cut open the grease pod. Place a small amount of the silicone grease around hole X in the chassis.

( ) Place a #6 lockwasher on each screw at A, B, C, and D.

( ) Mount the circuit board into the chassis so the red and black wires in one corner of the board are positioned near rectangular opening E in the chassis. Tighten the foot mounting hardware. Then secure the circuit board at A, B, C, and D with #6 lockwashers and 6-32 nuts as shown.

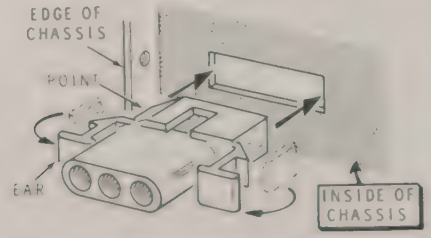
( ) Secure the transistor stud as follows. Hold the flat on the transistor stud firmly with pliers, then tighten an 8-32 nut onto the stud. This will prevent possible damage to the transistor.



Detail 7C

( ) Refer to Detail 7C and mount a phono socket at location G as shown in the Pictorial. Use 6-32 x 3/8" hardware. Be sure the socket is centered in its opening.

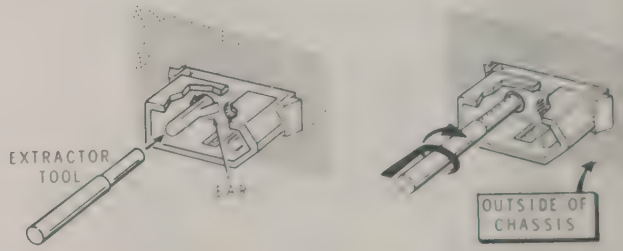
( ) In the same manner, mount the remaining phono socket at F.



Detail 7D

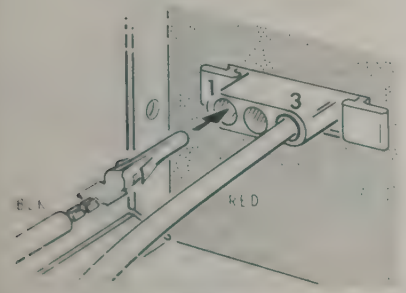
( ) Refer to Detail 7D and bend the ears of the 3-pin socket back against the side of the socket body as shown. Position the pointed side of the socket toward the edge of the chassis as shown. Then firmly push the socket from the inner side of the chassis toward the outside. The ears of the socket will lock in place on the edge of hole E.

Refer to Pictorial 8 (Page 19) for the following steps.



Detail 8A

NOTE: In the following steps, do not use middle hole 2 in socket E. An extractor is provided (see Detail 8A) so you can remove a pin from either the 3-pin plug or socket if necessary. To use the tool, push it firmly over the end of the pin, as shown, until it compresses the expanded ears of the pin. Then pull the wire and its pin from the other end of the housing.



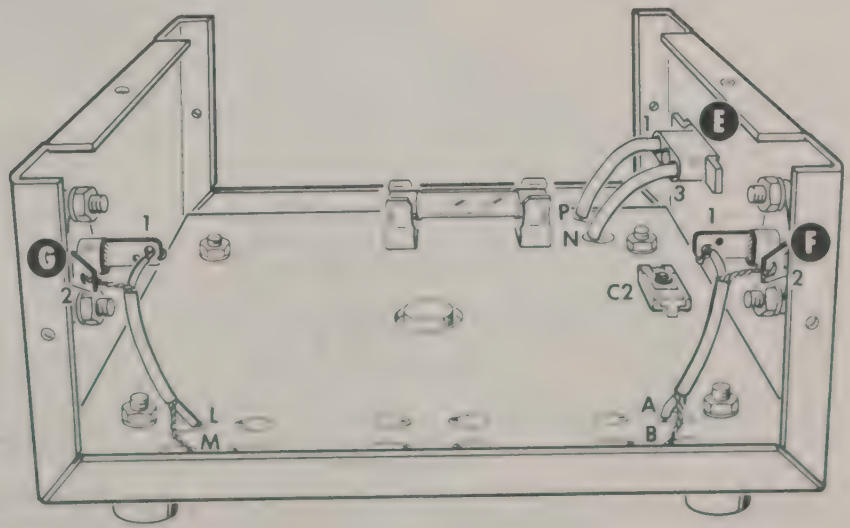
Detail 8B

( ) Refer to Detail 8B and push the pin on the red wire coming from circuit board location N into socket E hole 3. Be sure the pin is securely seated.

( ) In the same manner, push the pin on the black wire coming from circuit board location P into socket E hole 1.

( ) Position both the red and black wires away from capacitor C2.

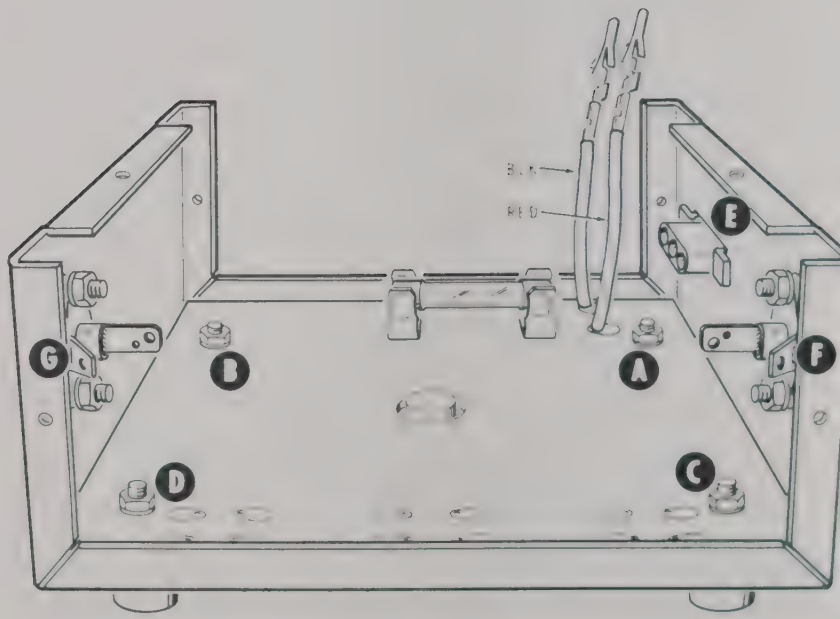
( ) Connect the free end of the shielded cable coming from circuit board locations A and B to phono socket F as follows. Connect the inner lead to lug 1 (S-1) and the shield lead to lug 2 (S-1).



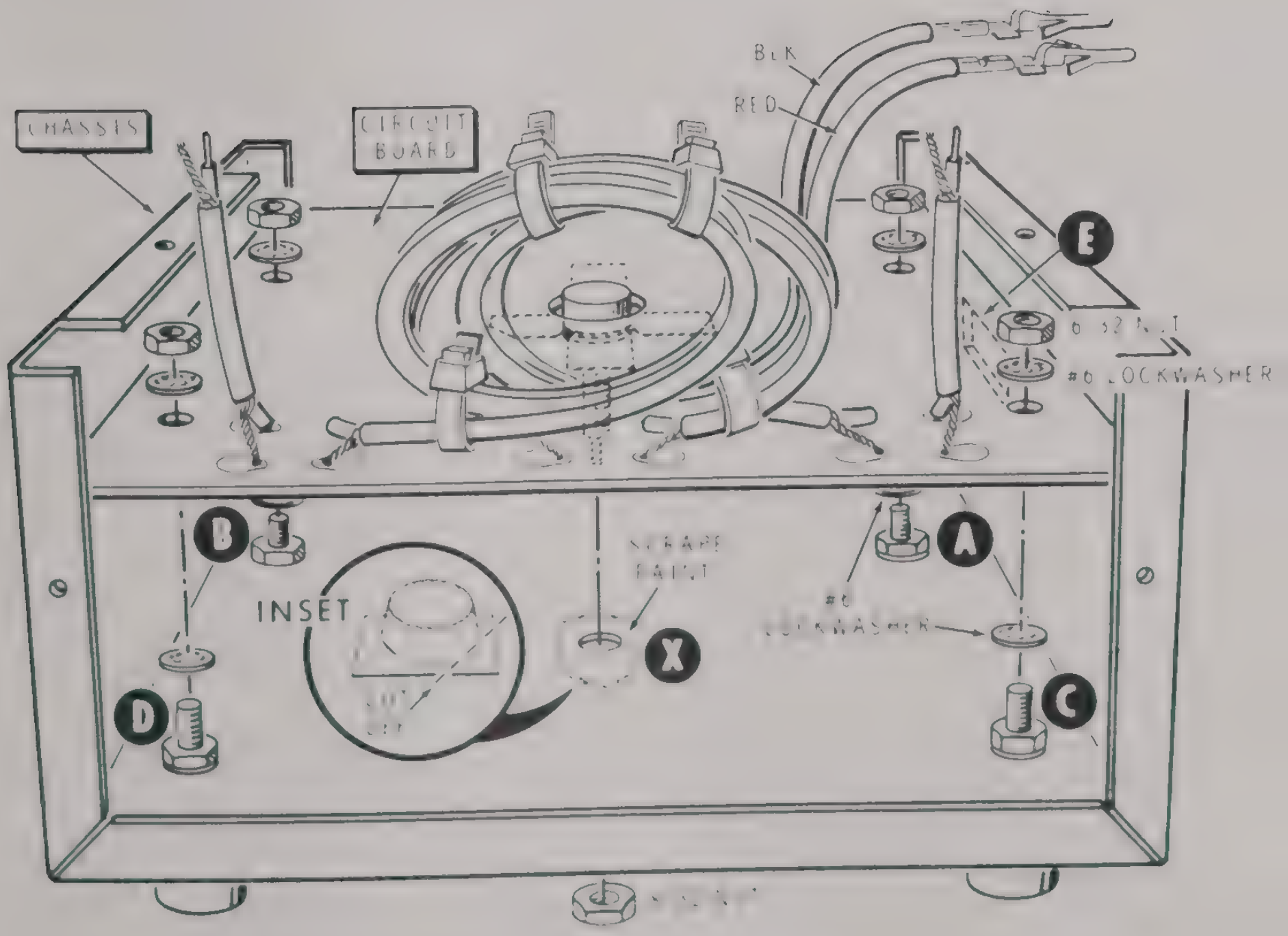
PICTORIAL 8

( ) In the same manner, connect the shielded cable coming from circuit board locations L and M to phono socket G. Inner lead to lug 1 (S-1) and shield lead to lug 2 (S-1).

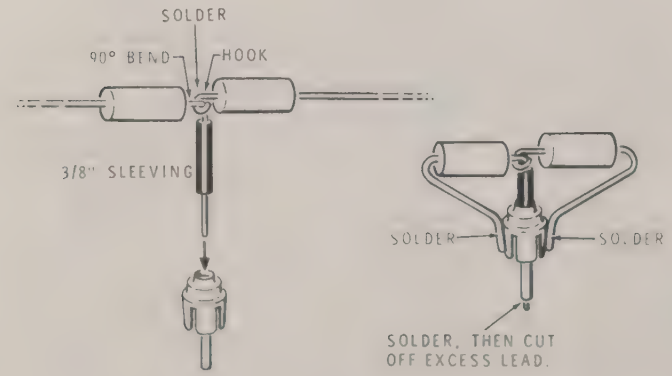
( ) Set the chassis aside temporarily.



PICTORIAL 7


CHASSIS
CIRCUIT BOARD
BLK
RED
#6 LOCKWASHER
INSET
SCRAPE PAINT
#6 LOCKWASHER
A
B
C
D
E
X

Detail 7B



PICTORIAL 9

50 Ω Dummy Load

Refer to Pictorial 9 for the following steps.

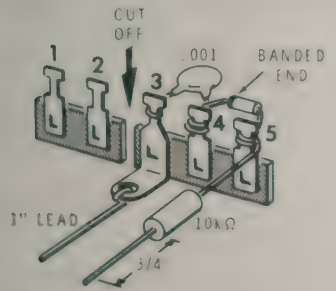
( ) R3 and R4: Two 100 Ω (brown-black-brown), 2-watt resistors. Bend the lead of one resistor 90 degrees. Cut the lead of the other resistor to 1 4" and form a loop in the short lead end. Connect and solder these two leads as shown.

( ) Cut a 3 8" piece of sleeving and slide it over the center lead of the resistors.

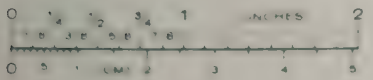
( ) Push this center lead into a phono plug. Heat the end of the plug with a soldering iron and flow a small amount of solder into the tip of the plug. After the solder has cooled, gently pull on the resistors to be sure of a good solder connection, then cut any excess resistor lead from the tip of the plug.

( ) Form both free resistor leads as shown in the Pictorial, so they are bent inward and against the outer shell of the phono socket. Solder each of these leads to the outer shell (S-2).

( ) Place the dummy load into the RF OUTPUT socket on the amplifier



PICTORIAL 10



Tune-Up Circuit Assembly

Refer to Pictorial 10 for the following steps.

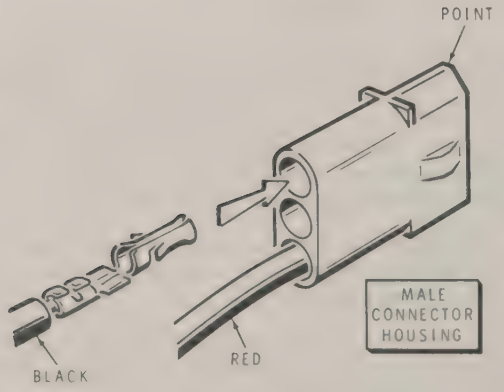
( ) C11: Cut both leads of a .001 μF disc capacitor to 1/2". Connect this capacitor between terminal strip lugs 3 (S-1) and 4 (NS) as shown in the Pictorial.

( ) D7: Cut both leads of a 1N4149 (#56-56) to 1/2". Connect this diode between terminal strip lugs 4 (S-2) and 5 (NS). NOTE: Be sure to position the banded end of the diode as shown in the Pictorial.

( ) R2: Cut both leads of a 10 kΩ (brown-black-orange) resistor to 3/4". Connect the lead on one end of the resistor terminal strip lug 5 (S-2). The free end will be connected later.

( ) Locate any cutoff component lead approximately 1" in length. Connect one end of this lead to the foot of the terminal strip (S-1). The free end will be connected later.

( ) Cut and discard lugs 1 and 2 from the terminal strip with diagonal cutters.



PICTORIAL 11

Power Supply Leads

Refer to Pictorial 11 for the following steps.

( ) Prepare one end of the long black stranded wire and one end of the long red wire.

Detail 11A

( ) Refer to Detail 11A and solder a female pin (#432-73) to the prepared end of the long black wire as shown.

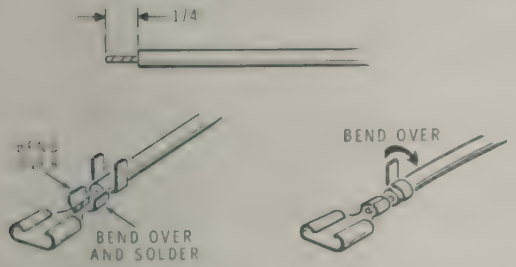
( ) In the same manner, solder a female pin to the prepared end of the long red wire.

( ) Position the 3-pin plug with the point up and push the female pin on the black wire into the upper hole as shown in the Pictorial, until the pin locks into place.

( ) Push the pin on the red wire into the lower hole, leaving the center hole open.

NOTE: Each installation will have its own requirements for wire and cable lengths. For this reason, no specific instructions will be given to cut the wires.

( ) Determine the lengths of red and black power supply (12.5 VDC) leads you will need between your battery, or power supply, and the amplifier. Cut each of these wires to the proper length.



Detail 11B

1. If your power supply positive (+) source has a spade lug to accommodate a push-on connector, remove 1/4" of insulation from the end of the red wire. Then solder the push-on connector to the wire end as shown in Detail 11B.

NOTE: If the push-on connector in the previous step is not used, proceed to the following step. Do not plug your power supply into the amplifier until you are instructed to do so.

2. Remove a desired length of insulation from the black, or black and red wires. Apply a small amount of solder to each of the bare wire ends.

3. Connect the black power lead to a battery ground or 13.6 volt negative (-) source. Connect the red power lead to the 13.6 volt positive (+) source.

Shielded Cable Preparation

NOTE: Since each installation will have its own requirements, only guidelines and examples will be cited in the following steps and paragraphs. Since standing-wave ratios (SWR's) play an important part in optimum tune up with some exciters, certain factors must be taken into consideration when you prepare the RF input cable.

Ideally, the input transmission line should be cut to approximately any odd number of quarter wavelengths. RG58A/U has been supplied with your kit. In the following examples, the velocity factor of 66% has been used for this cable. Tables in the Radio Amateur's Handbook will assist you in computing the proper lengths of various other types of transmission lines.

Assume that your amplifier will be positioned 3 feet from your 2 meter transceiver. As an example, assume that the transceiver has two crystal frequencies of 146.58 MHz and 147.26 MHz.

$$\text{Average frequency} = \frac{146.58 + 147.26}{2} = 146.92 \text{ MHz}$$

Use the following formula to determine a quarter wavelength:

$$\frac{\lambda}{4} = \frac{300 \text{ (meters)}}{\text{f (MHz)} \times 4}$$

To complete the formula: $\frac{\lambda}{4} = \frac{300}{146.92 \times 4} = \frac{300}{587.68} = 0.51$ Meters

Multiply by a velocity factor of 66%. A quarter wavelength = 0.337 meters, or 33.7 centimeters. To convert to inches, multiply by .39: or 33.7 x .39 = 13.2 inches.

It has been assume that we must have an input cable of approximately 3 feet in odd quarter wavelengths, or odd multiples of 13.2 inches in this case. By computation, 3 (odd wavelengths) x 13.2 = 39.6". This is the length to which the example transmission line would be cut.

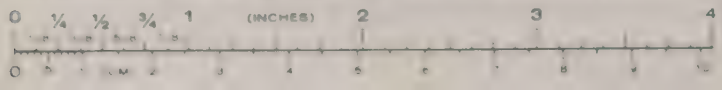
Refer to Pictorial 12 for the following steps.

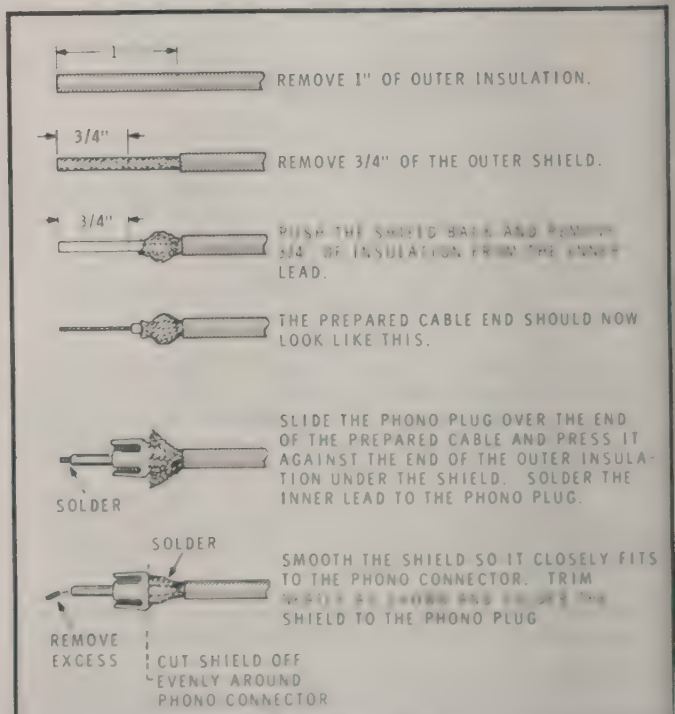
NOTE: You will prepare the large shielded cable in the following steps and install phono plugs on the cable ends. Again, individual application will determine the cable preparation for the transceiver-to-amplifier and the amplifier-to-antenna ends of the cables.

( ) Carefully measure the length of shielded cable (transmission line) required between the transceiver and the Amplifier. Also determine the necessary cable needed between the Amplifier and the antenna. Cut the large shielded cable to the measured lengths.

( ) Refer to the Pictorial and install one of the two phono plugs on one end of each cable. To avoid an impedance mismatch, be sure to install the plugs as shown.

This completes the "Step-by-Step Assembly" of your 2-Meter Amplifier kit.




1
REMOVE 1" OF OUTER INSULATION.
3/4"
REMOVE 3/4" OF THE OUTER SHIELD.
3/4"
LEAD.
THE PREPARED CABLE END SHOULD NOW LOOK LIKE THIS.
SLIDE THE PHONO PLUG OVER THE END OF THE PREPARED CABLE AND PRESS IT AGAINST THE END OF THE OUTER INSULATION UNDER THE SHIELD. SOLDER THE INNER LEAD TO THE PHONO PLUG.
SOLDER
SOLDER
SHIELD TO THE PHONO PLUG
REMOVE EXCESS
CUT SHIELD OFF EVENLY AROUND PHONO CONNECTOR

PICTORIAL 12

ALIGNMENT

ALIGNMENT NOTES

To avoid overheating and damaging the transistor, do not key the exciter continuously during alignment. A cycle of ten seconds on and thirty seconds off is recommended until the alignment has been completed.

Although it is unlikely, you could encounter low-frequency oscillation (squegging) under certain conditions of mistuning. When it is properly tuned, the Amplifier will not exhibit these oscillations, but low-frequency spurious output has been observed during alignment, and this condition can damage transistor Q1 if it is allowed to exist for very long. A portable broadcast receiver makes a good indicator when it is tuned to an unused frequency and placed near the Amplifier. The existence of squegging will be easily recognized as an unusual noise from the broadcast receiver.

If you use your automobile battery as a power source, check the voltage across its terminals with the engine running and all accessory equipment and lights turned off. This Amplifier is designed to operate at a maximum of 16 volts. If the voltage exceeds that amount, you should have your voltage regulator adjusted or replaced.

It is a good practice to start the alignment procedure at 11 to 12 volts. If you are using your automobile battery as a power source, leave the engine off during the initial steps. Then start the engine (in a well ventilated area) for the final tune-up.

5. The alignment of this Amplifier requires the following:

   a. A 2-meter FM exciter (transmitter) capable of 1 to 3 watts output.
   b. The kit-built dummy load.
   c. The kit-built tune-up circuit or an output indicator. A vhf wattmeter or SWR bridge is preferred, but a VTVM or VOM may be used. These instruments must be capable of measuring signals within the 2-meter spectrum.

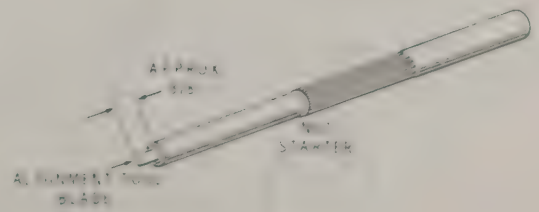


Figure 1

( ) Refer to Figure 1, and push the 1" blade into the small end of the nut starter as shown. This is now your alignment tool.

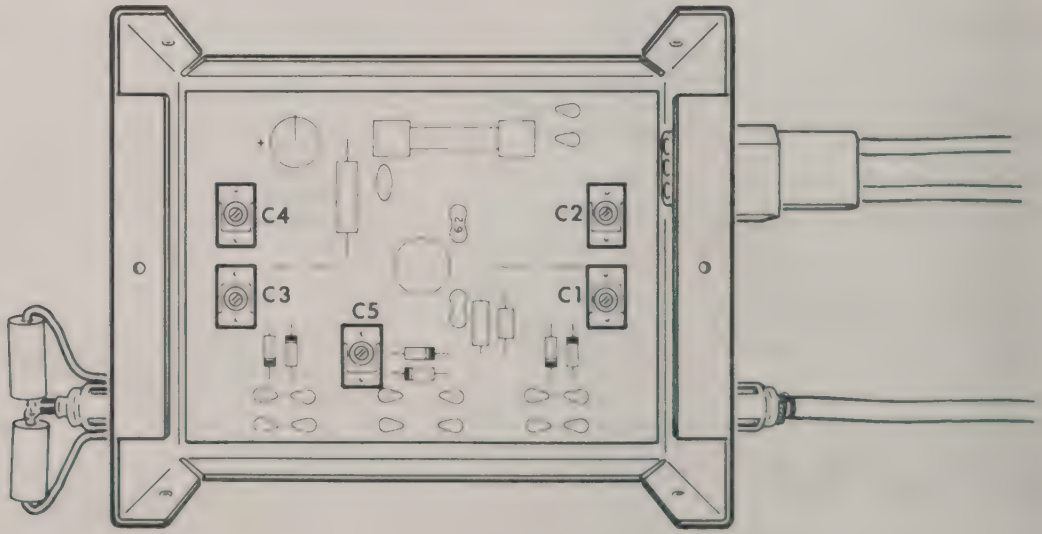


Figure 2

( ) Refer to Figure 2 and preset the following trimmer capacitors. First, turn each trimmer down until it is just snug; then turn each counterclockwise as indicated.

C1 1/4 turn
C2 1/8 turn
C3 1/8 turn
C4 1/4 turn
C5 1/4 turn

( ) Before you start to align your Amplifier, tune your exciter for a maximum output in the portion of the 2-meter band in which you expect to operate. **(See your exciter Manual.)**

LIGNMENT WITH WATTMETER OR SWR BRIDGE

a wattmeter or SWR bridge is used for alignment, it is important that it be pable of accurate measurements at the operating frequency of the Amplifier. therwise, there may be a false indication of peak power, and possible rsalignment. NOTE: If you do not obtain the proper results during the ving steps, refer to the "In Case of Difficulty" section of the Manual on

' wattmeter or an SWR bridge to the RF OUTPUT socket of the
An

( ) Connect a 50 Ω dummy load to the output of the wattmeter or bridge.

( ) Connect the exciter output to the RF INPUT socket of the Amplifier. Be sure the exciter is tuned for maximum output on the selected frequency, and use a cable cut to the proper odd multiple of a quarter wavelength.

NOTE: As you make the following adjustments, perform the operation one time only on each trimmer. Start with trimmer C1, then go to C2, then to C3, and so on. Do not, for instance, go back from C3 to C2, or from C4 to C1.

( ) Key the transmitter in short bursts. Adjust trimmer C1, then trimmer C2 through C5 for a maximum indication on the output meter. Use an AM receiver as described on Page 25. If you encounter low frequency oscillation – stop. Then, start over again with the initial trimmer adjustments at the positions described at the beginning of this page.

( ) If you have peaked your Amplifier from a mobile power source without the engine running, start the engine at this time to obtain a peak voltage. Once again, adjust trimmers C1 through C5, in order, for a maximum reading on the meter. However, do not turn any trimmer screw more than 1/8 turn.

This completes the adjustment of your Amplifier. Refer to "Final Assembly" on Page 29.

ALIGNMENT WITH VTVM OR VOM

( ) Refer to Figure 3 and temporarily solder the tune-up circuit to the lugs of phono socket G. Connect the 10 kΩ resistor lead to lug 1 and the bare wire to lug 2 of the socket as shown.

( ) Plug the 50 Ω dummy load into the RF OUTPUT socket.

( ) Connect the negative (ground) voltmeter lead to the tune-up circuit bare wire. Connect the positive (+) meter lead to the diode-capacitor junction on the tune-up circuit as shown.

( ) Connect the exciter output to the RF INPUT socket of the Amplifier. Be sure the exciter is tuned for maximum output on the selected frequency and that you have a proper length cable.

NOTE: As you make the following adjustments, perform the operation one time only on each trimmer. Start with trimmer C1, then go to C2, then to C3, and so on. Do not work backward, for instance, from C4 to C3 or C2.

( ) Key the transmitter in short bursts. Adjust trimmer C1, then trimmer C2 through C5 for a maximum indication on the output voltmeter. Use an AM receiver as described on Page 25. If you encounter low frequency oscillation – stop. Then, start over again with the initial trimmer adjustments at the positions described at the beginning of Page 27.

( ) If you have peaked your Amplifier from a mobile power source without the engine running, start the engine at this time to obtain a peak voltage. Once again, adjust trimmers C1 through C5, in order, for a maximum reading on the meter. The reading should be 2.0 volts or greater. Do not turn any trimmer screw more than 1/8 turn.

( ) Remove the tune-up circuit from lugs 1 and 2 of phono socket G.

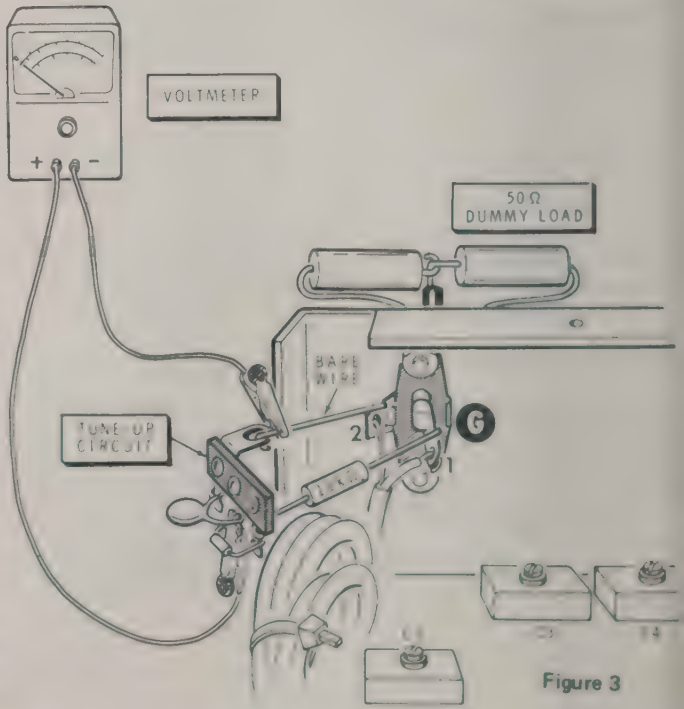


Figure 3

This completes the alignment of your Amplifier. Proceed to "Final Assembly

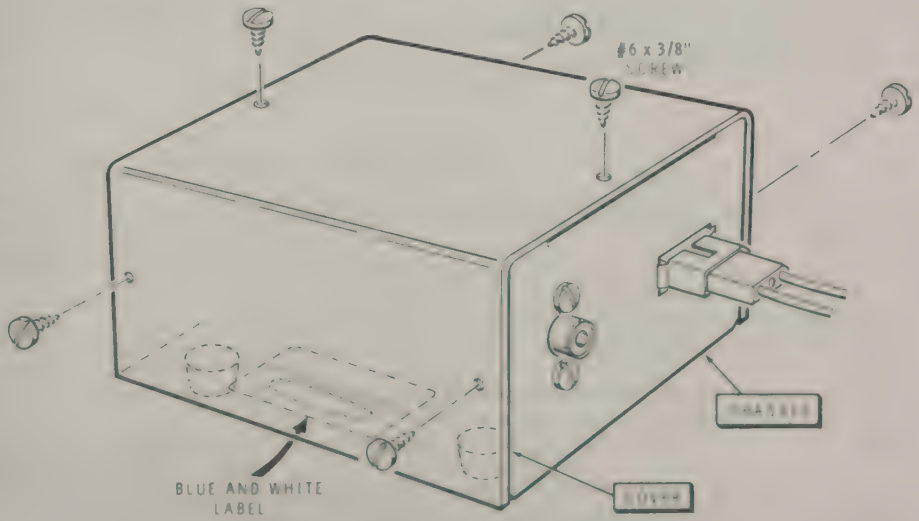
FINAL ASSEMBLY

efer to Pictorial 13 for the following steps.

) Secure the cover to the chassis with six #6 x 3/8" screws as shown.

) Remove the paper backing from the blue and white label and press the label in place on the underside of the chassis. Refer to the numbers on the label in any communications you have with the Heath Company about this kit.

is suggested that you put the dummy load and e tune-up circuit in a safe place so it can be adily located if you wish to readjust the mplifier trimmers in the future.



PICTORIAL 13

OPERATION

Operation of the Model HA-201 2-Meter Amplifier is entirely automatic. When the exciter is keyed, the automatic antenna switch transfers the power input to the amplifier. The output of the amplifier is connected to the antenna. In the receive mode, signals are passed straight through the circuitry to the associated receiver.

The interconnecting shielded cables between the transceiver and the Amplifier are cut to an odd multiple of quarter wavelengths to minimize tune-up problems.

IN CASE OF DIFFICULTY

1. Make sure there are from 12 to 16 supply volts present at the power connector.
2. The majority of the kits that are returned for repair do not function properly due to poor connections and soldering. Many troubles can be eliminated by carefully reheating all connections to make sure they are soldered as described in the Soldering section of the "Kit Builders Guide."
3. Check the values of the parts installed. Be sure that the proper part has been wired into the circuit for each step as shown in the Pictorial diagrams.
4. Recheck the wiring. It is frequently helpful to have a friend check your work. Someone who is not familiar with the unit may notice something consistently overlooked by the builder.
5. Check for bits of solder, wire ends, or other foreign matter which may be lodged in the wiring.
6. Make sure all excess lead lengths have been clipped from the foil side of the circuit board. Unclipped leads could cause a short circuit from the circuit board to the chassis.
7. A review of the "Circuit Description" may prove helpful in indicating where to look for trouble.
8. When a component (Q1, C2, R3, etc.) is mentioned in the "Possible Cause" column of the "Troubleshooting Chart," check that specific component to make sure it operates properly, together with those parts connected to it.
9. In an extreme case where you are unable to resolve a difficulty, refer to the "Customer Service" information inside the rear cover of the Manual. Your Warranty is located inside the front cover.

Troubleshooting Chart

CONDITION	POSSIBLE CAUSE
Fuse blows when DC power is applied.	1. Power leads reversed. 2. Solder bridge on circuit board foil. 3. Transistor Q1.
Fuse blows when RF excitation is applied.	1. Oscillation; retune capacitors C1 through C5. 2. Transistor Q1.
Low power output.	1. Retune capacitors C1 through C5. 2. Diodes D1 through D6. 3 Load impedance other than 50 ohms.
C1, C2, C3, C4, or C5 will not peak.	1. Replace trimmer 2. Antenna VSWR excessive.

SPECIFICATIONS

Frequency Range	143 to 149 MHz.
Power Output (at 13.6 VDC input)	
1-watt drive	8 watts.
1.5-watts drive	10 watts.
Power Input	1 to 3 watts.
Input/Output Impedance	50 ohms.
Maximum load VSWR	Infinite.
Power Requirement	12 to 16 volts DC, 2.2 amperes maximum
Dimensions (overall)	5-1/8" long x 3-5/8" wide x 2-3/4" high (13.02 cm. x 9.21 cm. x 6.97 cm.).
Net Weight	1 lb. (0.453 kg.).

The Heath Company reserves the right to discontinue products and to change specifications at any time without incurring any obligation to incorporate new features in products previously sold.

CIRCUIT DESCRIPTION

NTENNA SWITCH

fer to the Schematic Diagram (fold-out from Page 35) as you read the lowing "Circuit Description."

nen an output of one watt or more from an exciter is present at the amplifier put, input diodes D1 and D2 are forward biased and pass the signal to the ut of the amplifier. The amplified signal causes output diodes D5 and D6 to nduct and connect the amplifier to the load. At the same time, a small portion the driving signal causes midpoint diodes D3 and D4 to conduct. Trimmer pacitor C5 tunes the input and output switching transformers T1 and T2 to an ctrical quarter wavelength.

e midpoint diodes effectively short one end of each of the switching nsformers. Thus the input and output ends appear as open circuits to a signal, d the amplifier input and output (through the switching nsformer - transmission lines) are effectively isolated from each other.

Received signals are of sufficiently low amplitude to prevent diode conduction. Therefore, the received signals merely pass straight from the RF Output jack, to output and input transformers T2 and T1, to the RF Input jack, and to the receiver.

AMPLIFIER

Input trimmer capacitors C1 and C2, coil L1, and capacitors C6 and C7 match the 50-ohm input impedance to the low impedance base of transistor Q1. Resistor R1 and ferrite bead FB1 provide a low Q DC base return. Coil L2 and trimmer capacitors C3 and C4 match the low collector impedance of Q1 to the 50-ohm output.

Power is supplied from a 13.6 volt (nominal) DC source through fuse F1. Choke RFC1 and capacitors C8 and C9 provide decoupling between the Amplifier and the power supply.

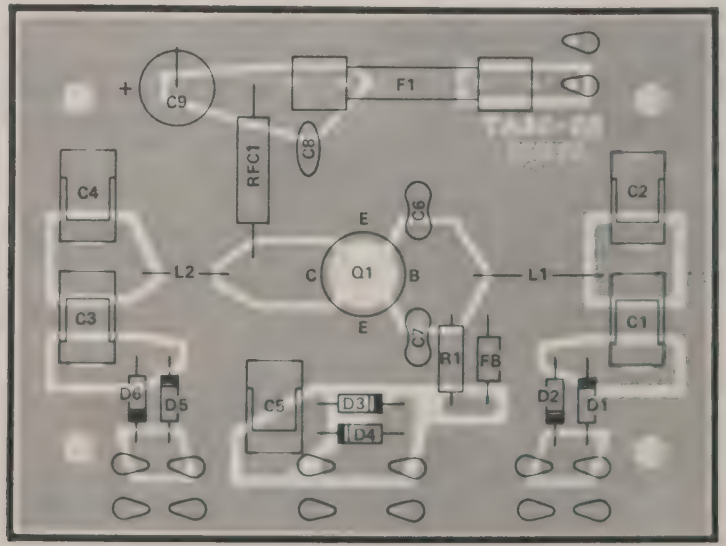
CIRCUIT BOARD X-RAY VIEW

NOTE: To find the PART NUMBER of a component for the purpose of ordering a replacement part:

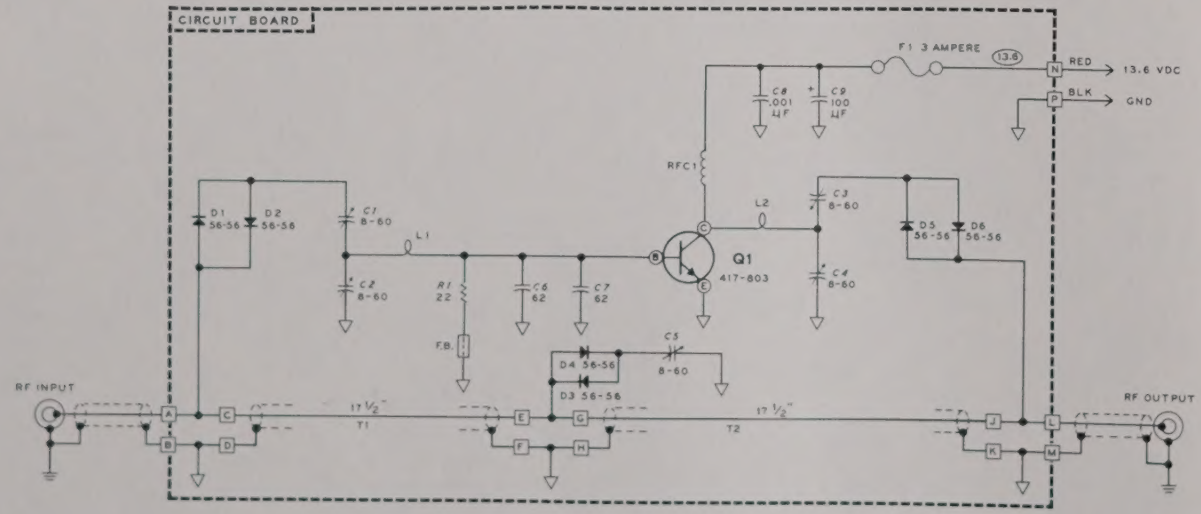
A. Find the circuit component number (R5, C3, etc.) on the "X-Ray View."

B. Locate this same number in the "Circuit Component Number" column of the "Parts List."

C. Adjacent to the circuit component number, you will find the PART NUMBER and DESCRIPTION which must be supplied when you order a replacement part.



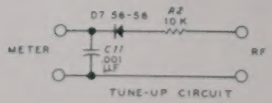
(Shown from component side)



NOTES:

1. RESISTORS ARE 1/2 WATT UNLESS OTHERWISE NOTED.
2. CAPACITORS ARE IN pF UNLESS OTHERWISE NOTED.
3. VOLTAGES ARE TAKEN WITH A HIGH IMPEDANCE INPUT VTVM FROM THE POINT INDICATED TO CHASSIS GROUND.
4. SYMBOLS USED:

CIRCUIT BOARD CONNECTION. CHASSIS GROUND.
CIRCUIT BOARD GROUND. FERRITE BEAD.



SCHEMATIC OF THE HEATHKIT® 2-METER AMPLIFIER MODEL HA-201

CUSTOMER SERVICE

REPLACEMENT PARTS

Please provide complete information when you request replacements from either the factory or Heath Electronic Centers. Be certain to include the **HEATH** part number exactly as it appears in the parts list.

Replacement parts are maintained specifically to repair Heath products. Parts sales for other reasons will be declined.

ORDERING FROM THE FACTORY

Print all of the information requested on the parts order form furnished with this product and mail it to Heath. For telephone orders (parts only) dial 616 982-3571. If you are unable to locate an order form, write us a letter or card including:

- Heath part number.
- Model number.
- Date of purchase.
- Location purchased or invoice number.
- Nature of the defect.
- Your payment or authorization for COD shipment of parts not covered by warranty.

Mail letters to: Heath Company
Benton Harbor
MI 49022
Attn: Parts Replacement

Retain original parts until you receive replacements. Parts that should be returned to the factory will be listed on your packing slip.

OBTAINING REPLACEMENTS FROM HEATH ELECTRONIC CENTERS

For your convenience, "over the counter" replacement parts are available from the Heath Electronic Centers listed in your catalog. Be sure to bring in the original part and purchase invoice when you request a warranty replacement from a Heath Electronic Center.

TECHNICAL CONSULTATION

Need help with your kit? — Self-Service? — Construction? — Operation? — Call or write for assistance. you'll find our Technical Consultants eager to help with just about any technical problem except "customizing" for unique applications.

The effectiveness of our consultation service depends on the information you furnish. Be sure to tell us:

- The Model number and Series number from the blue and white label.
- The date of purchase.
- An exact description of the difficulty.
- Everything you have done in attempting to correct the problem.

Also include switch positions, connections to other units, operating procedures, voltage readings, and any other information you think might be helpful.

Please do not send parts for testing, unless this is specifically requested by our Consultants.

Hints: Telephone traffic is lightest at midweek — please be sure your Manual and notes are on hand when you call.

Heathkit Electronic Center facilities are also available for telephone or "walk-in" personal assistance.

REPAIR SERVICE

Service facilities are available, if they are needed, to repair your completed kit. (Kits that have been modified, soldered with paste flux or acid core solder, cannot be accepted for repair.)

If it is convenient, personally deliver your kit to a Heathkit Electronic Center. For warranty parts replacement, supply a copy of the invoice or sales slip.

If you prefer to ship your kit to the factory, attach a letter containing the following information directly to the unit:

- Your name and address.
- Date of purchase and invoice number.
- Copies of all correspondence relevant to the service of the kit.
- A brief description of the difficulty.
- Authorization to return your kit COD for the service and shipping charges. (This will reduce the possibility of delay.)

Check the equipment to see that all screws and parts are secured. (Do not include any wooden cabinets or color television picture tubes, as these are easily damaged in shipment. Do not include the kit Manual.) Place the equipment in a strong carton with at least THREE INCHES of *resilient* packing material (shredded paper, excelsior, etc.) on all sides. Use additional packing material where there are protrusions (control sticks, large knobs, etc.). If the unit weighs over 15 lbs., place this carton in another one with 3/4" of packing material between the two.

Seal the carton with reinforced gummed tape, tie it with a strong cord, and mark it "Fragile" on at least two sides. Remember, the carrier will not accept liability for shipping damage if the unit is insufficiently packed. Ship by prepaid express, United Parcel Service, or insured Parcel Post to:

Heath Company
Service Department
Benton Harbor, Michigan 49022

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HEATH COMPANY • BENTON HARBOR, MICHIGAN

THE WORLD'S FINEST ELECTRONIC EQUIPMENT IN KIT FORM

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